# 1. Defining the main research questions of the literature review.

- How do you ensure a sufficient level of component obfuscation for each company while maximizing material utilization?
- How can we be sure to minimize the waste, while maximizing material utilization?

# 2. Defining keywords.

- Cutting Stock Problem (CSP).
- Cutting reusable leftovers.
- Optimized cutting steel plates.
- Rectangular cutting patterns.
- Heuristic cutting patterns.
- CSP in aluminium industry.
- Minimize Cutting Waste.
- Multistage CSP.
- Reusable Leftovers.
-Trim-loss problem.

# 3. Defining search string.

- (CSP **OR** Multistage CSP **OR** Cutting Stock Problem) **AND** (Cutting reusable leftovers **OR** Reusable Leftovers **OR** Leftovers **OR** Scraps) **AND** (Minimize Cutting Waste **OR** Waste) **AND** (Rectangular cutting patterns **OR** Heuristic cutting patterns **OR** CSP in aluminium industry)

# 4. Defining search engines.

- Google Scholar
- IEEE Xplore
- Scopus

# 5. String refinement.
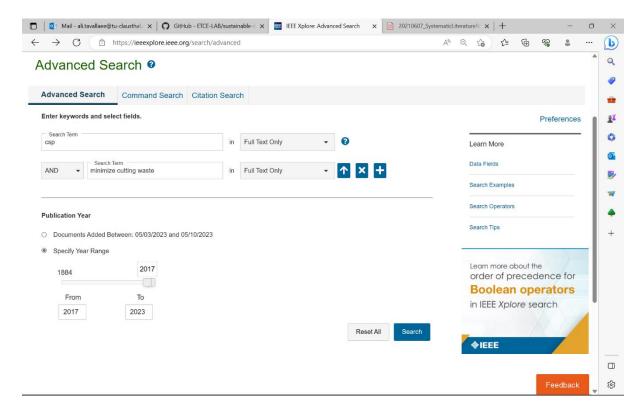
The search results were obtained on 11th May 2023.

- Academic Search Engines used: IEEE, Google scholar and Scopus
- Search string used for academic search: "csp" AND ''minimize cutting waste''
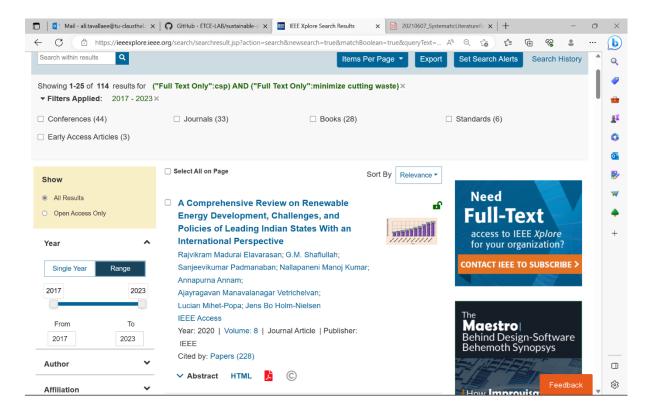
Search Engine Result:

| Search Engine | Number of result |
|---|---|
| Google scholars | 200 |
| IEEE Xplore | 114 |
| Scopus | 2 |

Note: for Google Scholar and Scopus I used the tool Publish and Perish.
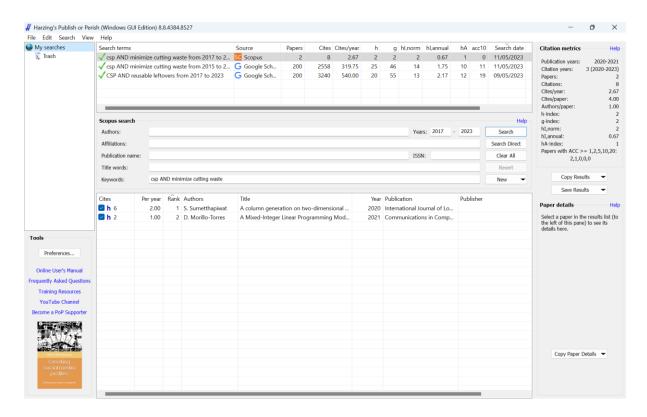
# A. search results in IEEE:



I have stored and **attached** the search result of above as a CSV file to email. Then result from this:

The search results can be found in a CSV file attached in email.
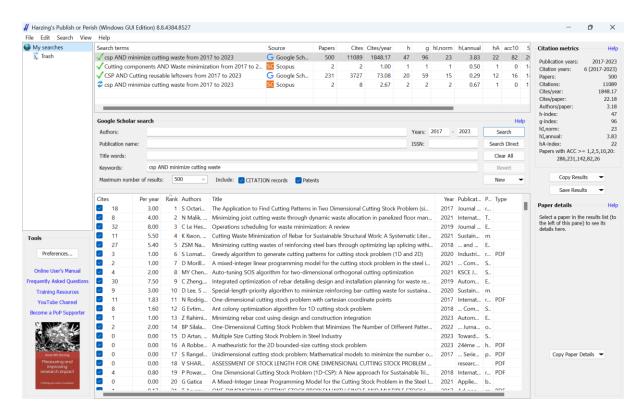
*Note: for  **Scopus** and **Google Scholar** the tool Publish and Perish is used to obtain the search results.*

# B. search results in Scopus:



Then I stored the search result as a CSV file which is attached in the email.

## C. search results in Google Scholar:



I have stored the search result for it in a CSV file attached in email.

## 6.Search string execution.

**IEEE Xplore :** I used ''csp AND minimize cutting waste'' as two keyword at 11.05.2023 in '' FULL TEXT ONLY'' for 2017-2023 time interval and the number of result was 114.

**SCOPUS :** I used ''csp AND minimize cutting waste'' as two keyword at 11.05.2023 for 2017-2023 time interval and the number of result was 2.

**Google Scholar :** I used ''csp AND minimize cutting waste'' as two keyword at 11.05.2023 for 2015-2023 time interval and the number of result was 200.

## 7.Download and store search results

The search result for these 3 search engines has been stored in a CSV file separately and attached by email.

## 8.Define inclusion and exclusion criteria.

I considered as systematic literature review suggested the following criteria through problem description and main research questions:

First, I consider which papers or articles go to the next stage of review by including : components cut out of pre-manufactured standardized materials ( in this case I give the priority to rectangular cuts and plates). Then after considering this, I went through minimizing waste and useful leftovers for the company. Co-operating different companies is also considered with unknown dimensions for their products.
Another inclusion for me is that which papers, articles and etc. are in English language.
Finally, some papers, articles and etc. are restricted the area (Germany).

## 9.Selection of papers - First stage - Analysis by title and abstract.

Based on previous criteria and abstract of papers:
- DYCKHOFF paper: in this paper based of its abstract, first I tried to categorized and characterized the cutting stock problems (there are no standard form for objective function, constraints or solution approaches etc.)
- REZAEI paper: then in this paper, minimizing production waste, two-dimensional cutting stock problem and finally considering regular (rectangular) and irregular (non-rectangular) shapes for cutting, caught my attention.
- ROTHE paper: usable leftover and even considering the case that leftover materials will be reused in another production cycle or company, check-mated me.

## 10.    Selection of papers - Second stage - Analysis by Introduction and Conclusion. (Optional)

## 11.    Selection of papers - Third stage - Complete reading and quality checklist.

I read all of the three mentioned papers and found them related and usable for my report. Reading and observing all resulted papers takes a huge time of me.

## 12.Extraction of answers related to research questions.

By considering mentioned above papers, I have created a spreadsheet and showed that each of them signaled me in which direction. Please look over the spreadsheet for this stage ( please check PDF file! ).

## Problem description:

Company A **cuts components** (e.g., vehicle parts) out of **pre-manufactured standardized materials plates** (e.g., **rectangular** aluminium plates). They already employ algorithms to perfectly cut the components out of those material plates while **minimizing waste** (essentially, as little as possible is **left over** after cutting out their components). In most cases, there is still enough material left to allow other companies (e.g., company B and company C) to cut out further pieces for their own products. However, neither companies A, B, nor C would be happy to **disclose the exact dimensions** of their products to anyone. Therefore, we need to **obfuscate the dimensions of each company's products** while utilising as many materials plates as possible (**minimizing leftovers**).

How do you ensure a sufficient level of component obfuscation for each company while **maximizing material utilization**?